DESCRIPTION OF SAMPLING PROGRAMME FOR PART OF FORT BENNING

Second Interim Report (RSSUSA - 2)

by

Dr Margaret A Oliver and Professor Richard Webster

(February 1995 to April 1995)

United States Army

ENVIRONMENTAL RESEARCH OFFICE OF THE U.S. ARMY

London, England

CONTRACT NUMBER - N68171 - 95 - C - 9007

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	19.01.95	Interim - Oct 1994-Jan 1995

4. TITLE AND SUBTITLE
Description of sampling programme for part of Fort Benning

5. FUNDING NUMBERS
PR-N68171
95-C-9007

6. AUTHOR(S)
Dr M A Oliver, Professor R Webster

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
University of Reading, Whiteknights,
Reading, RG6 2AH, UK.

8. PERFORMING ORGANIZATION REPORT NUMBER
RSS USA-2

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
USARDSG-UK
Environmental Sciences Branch
Edison House, 233 Old Marylebone Road
London, NW1 5TH, UK

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
The spot image data has just been received from TEC

12a. DISTRIBUTION/AVAILABILITY STATEMENT
No limitations on distribution/availability

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This report describes the site to be studied, i.e. Fort Benning, from the SPOT image. This area is used for heavy artillery, tank and parachute training.
Environmental protection is important and the sampling will aim to monitor the condition of this area.
Our first task will be to design a scheme using only information from the pattern in the image for a 3m x 3m area, and for two smaller areas within this: an area with the Red Cockaded Woodpecker and one cleared for parachute training that is eroding heavily.
The spatial scale and structure of the variation will be determined using the variogram, and the latter will be used in kriging the vegetation to produce a map.
In addition we shall examine the effect of different spatial scales on the variogram and the consequences for sampling.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Fort-Benning, SPOT image, sampling, variogram, unsupervised classification	3
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

NSN 7540-01-280-5500

Standard Form 298 (Rev 2-89)
Prescribed by ANSI Std. Z39-18
298-102

ATTACHMENT 1
PAGE 1 OF 2

DESCRIPTION OF SAMPLING PROGRAMME FOR PART OF FORT BENNING

ABSTRACT This report follows Dr Oliver's visit to the Topographic Engineering Center and an examination of the SPOT image covering Fort Benning. The study area is part of the Fort, and within it two subregions have been chosen. Optimal sampling schemes will be designed based on the pattern identified in the raw image from the variogram. The variables composing the image will be mapped from the data by kriging, and the results compared with ground information. In addition an unsupervized classification will be used to stratify the image.

INTRODUCTION

Dr M. A. Oliver visited the Topographic Engineering Center to discuss the project on sampling remote imagery with Mr K. Slocum and Mrs J. Jarrett in March 1995. This was opportune as they had recently received the tape of the SPOT image. It gave everyone a chance to consider the merits of examining different parts of the image. It also enabled a programme of tasks to be established. The subject of this report will be a description of the area of the SPOT image, the areas chosen for the research and the work schedule.

SPOT IMAGE

The SPOT image was recorded in November 1994. It has a resolution on the ground of about 20 m $\times$ 20 m. There are three wave bands: Near Infra Read (NIR), Red, and Green. The image of interest covers Columbus, Georgia, and it embraces all of Fort Benning to the East. Fort Benning covers some 70% of the area of the image. The area traverses the fall line between the coastal plain and the Piedmont and comprises hills of sand. The terrain is heavily dissected and wooded with many species. The plant communities are heterogeneous.

Fort Benning is a heavy artillery training installation operating under US Army Forces Command. Parachute and tank training are also important activities. As the frequency and intensity of training has increased so has the damage to the soil surface and vegetation.

The demands of training conflict with those of protecting the environment. Specifically, soil erosion is severe where the land is cleared for parachuting at McKenna Hill, Kudzu is spreading uncontrollably and choking other vegetation, and the habitat of several endangered species is threatened. The habitat of one species of particular interest to Mr Slocum is the Red Cockaded Woodpecker (RCW). The Integrated Training Area Management System (ITAMS) programme, now 10 years old, provides an inventory of the Army's training sites. It aims to balance the training needs with those of the environment. Despite the inevitable conflict of interest, it attempts to maintain the sites in as natural a condition as possible.

TEC's help has been enlisted to introduce new technology for assessing and monitoring the condition of such sites and to advise on the rehabilitation of the training grounds so that vegetation will regenerate and reestablish the habitats of certain protected species. Our involvement in this will be to design a sampling schemes for the fieldwork, and to map the vegetation using geostatistical methods.

EXISTING INFORMATION

Much information has been collected on the vegetation of the Fort as part of the ITAMS inventory. This is the work of the Land Condition Trend Analysis (LCTA) module. LCTA has recorded vegetation on transects throughout the area. There is some concern as to how representative this information is and whether the basis of recording is the best possible. We hope to be able to choose an optimal way of obtaining representative information, i.e. obtain the required information with minimal field work. However, it may not be possible to improve on the LCTA information, but we should know whether or not it is possible. Mr Slocum will ascertain whether any of the LCTA transects crossed the areas we intend to examine in detail.

PRPGRAMME OF WORK

Our main task is to design a sampling scheme using only information from the pattern in the image. If this is feasible it could save much effort. The assumption underlying this is that the pattern in the image relates to meaningful information on the ground. As a first requirement the spatial scales in the image must be the same as those of the features on the ground, e.g. the vegetation or the landform.

We have selected a region of approximately 3 miles $\times$ 3 miles in which to work. It encompasses the area where Mr Slocum is already examining the habitat of the RCW. Overall there is considerable variation in landform and vegetation, especially in the marshes along Ochillee Creek. In addition it embraces the cleared parachute training ground, which is now suffering severe erosion.

In the last we shall try to describe the pattern and to design a sampling scheme for fieldwork so that we can distinguish uneroded land, land on which there is sheet-wash, rills and gulls, and fans. If there is a good relation between the pattern identified on the image and the features on the ground then sites for monitoring the erosion can be chosen using the image and ground data. It might then be possible to monitor the erosion from the image. As previous SPOT images of this area exist they might provide a means of assessing how rapidly erosion is occurring.

The spatial scale and structure of the variation will be determined using the variogram. All three wave bands will be examined. For vegetation the NDVI index, i.e. (NIR-Red)/(NIR+Red), is usually used, and we shall also work with this. Using the variogram and the kriging equations we shall design an optimal sampling sheme for the fieldwork in June. The vegetation or condition of the land will be examined at each sampling point in a predefined way. In addition we shall examine the effect

of different spatial scales on the variogram and the consequences for sampling. To do this we shall work on areas of increasing size.

The image data will then be mapped using kriging, and the map will be compared with the ground information. The resulting map will then be used as a basis for validation in the second period of fieldwork in the Autumn. Sampling points will be chosen at random to assess the quality of the map.

In addition, we shall consider a more conventional approach whereby an unsupervized classification of the image is used to stratify the sampling. This will be compared with the geostatistical approach in identifying the main categories of vegetation.